

Efficiency Terminal

Portable analyzer for three-phase electrical network

Professional instrument indispensable for making samplings of 56 electrical parameters and other digital and analog measures.



User guide

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Reliable:

It allows you to make, with extreme precision, measurement campaigns on three-phase and single-phase electrical lines, it can store until 250 days of continuing recordings (with integration interval of 15 minutes, with following values: phase and concatenated voltage, three-phase line current, three-phase active power, three-phase power factor) detecting, for these electrical sizes, values with an error less than $\pm 0,5\%$ for the selected full-scale.

In addition, it's possible to make samplings of measures and parameters different from those electrical, by enabling the relative options.

Versatile:

The extreme flexibility of the instrument allows you to measure with extreme precision, within the selected scale, a wide variety of electrical loads.

By means of the amperometric Rogowski probes it's possible to make measurements from 5 to 2000 Ampère and to maintain unchanged the stated accuracy. Practically, it's an instrument for every circumstance, for sampling and **analyzing whatever load, from battery-charger for cellular phones to consumption of a melting furnace.**

Functional:

The parameters and measurement reports are easy to program. It's also equipped by an USB port for a simple and fast data transfer to PC. The analysis can be carried out by means of ES3-Evo processing software, included with the instrument.

It also includes Nr. 3 amperometric Rogowski probes with a measuring range from 5 to 2000 Ampère and Nr. 4 cables in silicon CAT III – double insulation; both endowments have a length of 2,5 meters, making possible the use also in the most critical situations of housing.

Portable:

The small size, the life of the battery and the possibility to be supplied also by an external module, allow you to make measurement campaigns according to the desired duration.

The particular shape makes this device practical and handy to use both in the field and on your desktop.

Software:

The Software Es3-Evo, specialized in Energetic Efficiency, is used by thousands Companies. It locates effectively the wastes and decreases the costs.

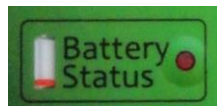
ENDOWMENT OF THE MAIN EQUIPMENT

- 50 electric measurements performed.
- Recording of voltage gaps and peaks with a resolution of 10 mms.
- Recording up to the 25th harmonic on voltages and currents.
- Graphic display with choice in character size.
- USB communication port.
- Measurements in true RMS values.
- Four-quadrant measurements.
- Clear displaying of the measured values.
- Simple and basic programming of the parameters and the measurement reports by means of the keyboard.
- Graphic visualization on the display of: Voltage, Current, Power, $\cos\phi$, harmonics and THD of the last 3 days.
- 12 four-quadrant energy totalizers.
- Clock and calendar.
- Three voltage inputs up to 300V Line-Neutral and 500V Line-Line.
- Overall accuracy: 0.50% full scale (measurement value).
- Predisposed with external connectors for the insertion of: 2 digital input channels through a mini Din connector; USB for data monitoring by PC, Voltage and Current Inputs; connector for external power supplier.
- Weight: 800 gr.
- Power supply: 12 Vdc by internal Lithium-ion battery, autonomy 8 hours. Provided by external power supplier 230Vac / 12Vdc for recharging the battery.
- Operating temperature: $-10^{\circ}\text{C} \div +55^{\circ}\text{C}$.
- Relative humidity: 95% without condensation.
- Connection cable from USB port to PC: 1,5 mt.
- Es3-Evo Software for the supervision, storage and handling of collected data.
- User's manual for the device and the software.
- Compliance: EN 55011, (Class A) EN 61000-4-2, EN 61000-4-3, EN 61000-4-4, EN 61000-4-5, EN 61000-4-6, EN 61000-4-11, EN 60204-1.
- Nr. 3 Rogowski probes, flexible and open ended, tightening diameter: 100 mm. Accuracy: Class 0,5. Cable length: 2,5 m. Single and Three-phase measurement (from 1 to 3 collectors). Full-scale output capacities: 60, 125, 250, 500, 1000, 2000 Ampère.
- Nr. 4 silicon CAT III - double insulation cables for measurement under tension. Length: 2.5 m, with Nr. 4 magnetic terminals for an easy application on the clamps; interchangeable with "crocodile" clips, also included.
- Compatibility: EN 50081-1 Class B, EN 50082-2, CEI 1000-4-2, CEI 1000-4-3, CEI 100-4-4, CEI 1000-4-8, CEI 1010-1, CEI 1010-2-032.
- Calibration certificate.

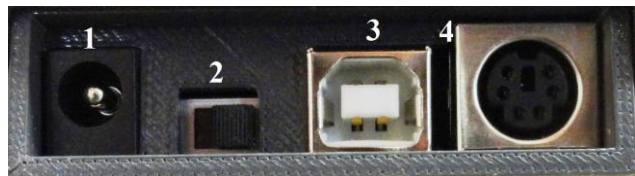
FUNCTIONALITY AND USE OF THE EQUIPMENT:

Through the enclosed Rogowski probes and the cables for voltage measurements, it's possible to detect 56 electrical parameters concerning to loads and lines under test.

The internal battery provides a power supply of 12Vdc and can be recharged through an external power supplier enclosed, which can be connected to electrical line.



The light indicator on the keyboard alerts you when the internal battery needs to be recharged.



Interfaces on the rear of the instrument:

- 1) Input for battery-charger.
- 2) ON / OFF switch.
- 3) USB port for connection to PC.
- 4) mini-DIN connector for digital Inputs.

Turn ON the equipment by means of the switch on the rear and, according to the type of connection make on the load, (**see wiring diagrams and measurements**) begin to set the instrument using the keyboard, as explained in the specific chapter (**Programming Efficiency Terminal by keyboard**).

In relation to the previously made, through the keyboard you can proceed to select the full-scale more appropriate for measurement.

For example: In order to measure a current value near 100 Ampère, you should set a full-scale of 125A. In this way you can get a precise measurement, according to real value.

The procedure for setting the full-scale in the Efficiency-Terminal is described in the paragraph about **Rogowski probes** (pag. 11) and in the one about **Programming by keyboard** (pag. 16).

Hence, the equipment is able to acquire and store the data of the electrical sizes, as it was programmed. We remember that, in the default configuration, the integration time set is 15 minutes and concerns the following measures:

- Concatenated Voltage.
- Phase Voltage.
- Three-phase line Current.
- Three-phase active Power.
- Three-phase reactive Power..
- Three-phase Power Factor.

In this configuration the equipment **can record until 250 days continuously**.

It's possible to increase the number of the storable electrical parameters, until to acquire entirely those that the system can measure; it's also possible to change the integration interval for the stored sizes, until 1 minute and 56 electrical parameters.

In order to operate within the section concerning the storage of the electrical parameters, you must load on the PC the management and analysis software for data acquired: Es3-Evo.

Perform the same procedure also for the following operations:

- Download, on your PC, data concerning the electrical measures for displaying graphs and tables regarding the Software Es3-Evo.
- Download data for making export into text format (Evd or Excel).
- Connect locally with your PC for displaying online the measured sizes.

Refer to user manual of the Software Es3-Evo.

LIST OF MEASURES AND CONFORMITIES

Single-phase direct measures

- Phase-neutral Voltage L1-N
- Phase-neutral Voltage L2-N
- Phase-neutral Voltage L3-N
- Phase-phase Voltage L1-L2
- Phase-phase Voltage L2-L3
- Phase-phase Voltage L3-L1
- Line current L1
- Line current L2
- Line current L3
- THD
- Voltage harmonics until 25th
- Current harmonics until 25th

Single-phase derived measures

- Bidirectional active Power L1, positive=imported (Q1 and Q4), negative=exported (Q2 and Q3)
- Bidirectional active Power L2, positive=imported, negative=exported
- Bidirectional active Power L3, positive=imported, negative=exported
- Bidirectional reactive Power L1, positive=imported (Q1 and Q4)
- Bidirectional reactive Power L2, positive=imported
- Bidirectional reactive Power L3, positive=imported
- Distorting Power L1 (It denotes the presence of harmonics in the current)
- Distorting Power L2 (It denotes the presence of harmonics in the current)
- Distorting Power L3 (It denotes the presence of harmonics in the current)
- Apparent Power L1
- Apparent Power L2
- Apparent Power L3
- Power Factor L1
- Power Factor L2
- Power Factor L3

Main measures on the three-phase system

- Three-phase equivalent Voltage phase-neutral
- Three-phase equivalent Voltage phase-phase
- Three-phase equivalent Current
- Three-phase active Power, positive=imported (Q1 and Q4), negative=exported. Bidirectional
- Three-phase active Power, positive=imported (Q1 and Q2). Bidirectional

Secondary measures on the three-phase system

- Three-phase equivalent distorting power
- Three-phase equivalent apparent power
- Three-phase equivalent power factor
- Neutral current, calculated
- Ideal Neutral Star-center (N-O) Voltage
- Frequency (measured on the Input voltage L)
- THD
- Voltage harmonics, until to 25th
- Current harmonics, until to 25th

Integrated measures and energy on the three-phase system

- Imported active Energy (Q1 e Q4)
- Imported active Power (Q1 e Q4)
- Exported active Energy (Q2 e Q3)
- Imported reactive Energy (Q1)
- Imported reactive Energy (Q2)
- Imported reactive Energy (Q3)
- Imported reactive Energy (Q4)
- Imported active Power (Q2 e Q3)
- Imported active Power (Q1)
- Imported active Power (Q2)
- Imported active Power (Q3)
- Imported active Power (Q4)

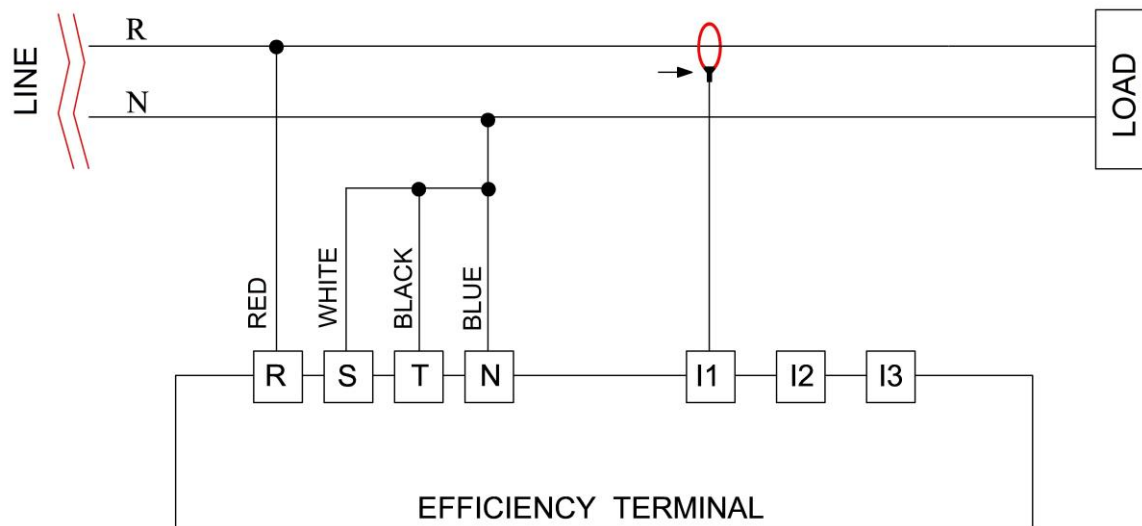
CONFORMITIES

Standards applied

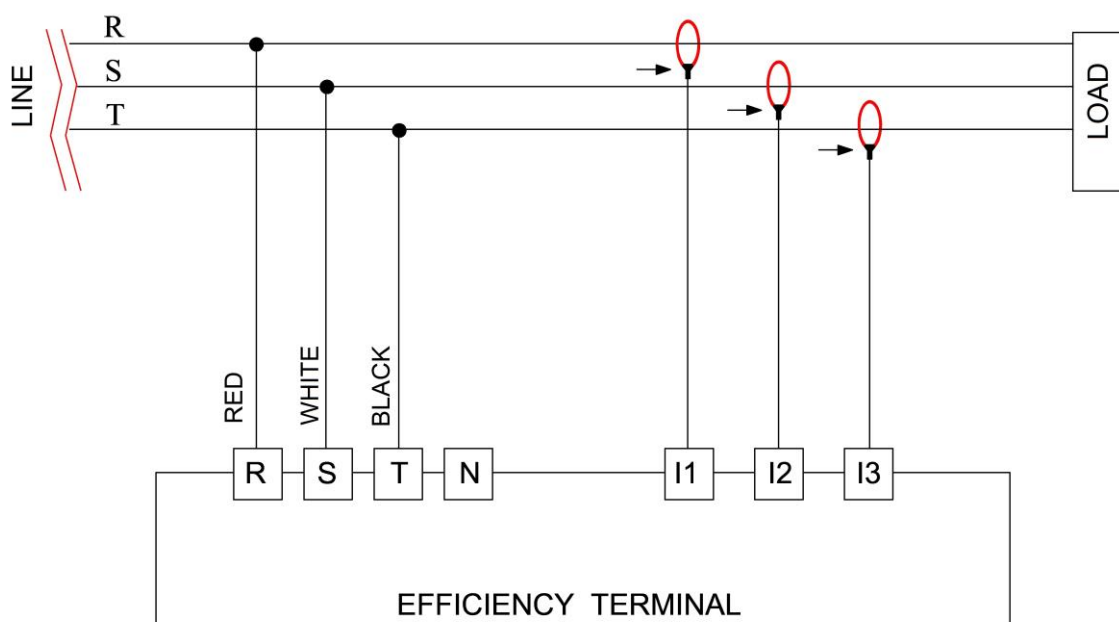
- EN 55011 (Class A)
- EN 61000-4-2 EN 61000-4-5
- EN 61000-4-6
- EN 61000-4-11
- EN 61000-4-3
- EN 61000-4-4
- EN 60204-1

WIRING DIAGRAMS AND MEASUREMENTS

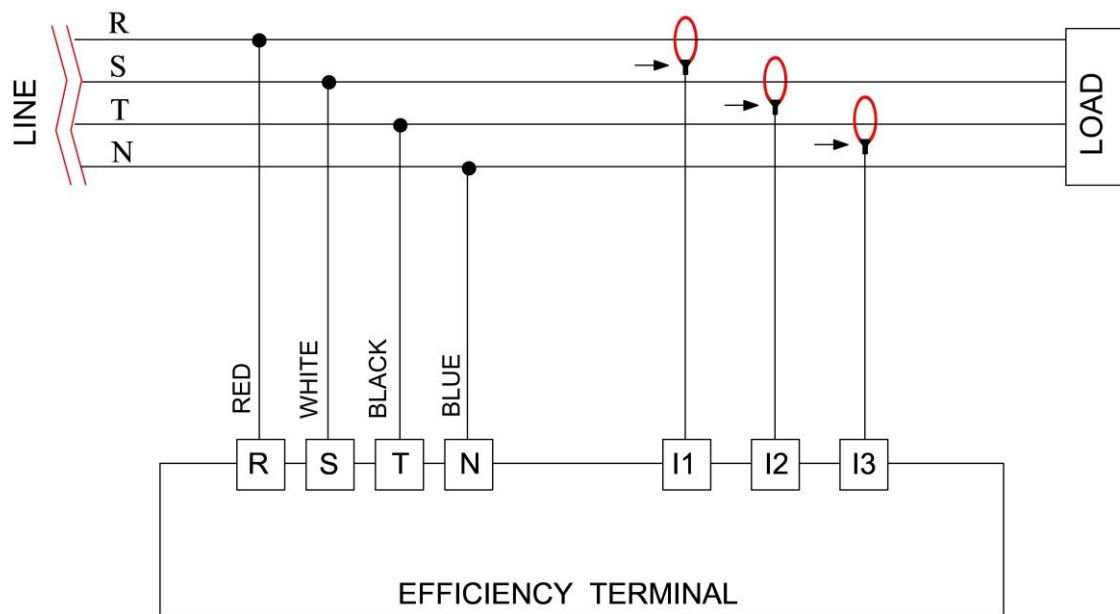
DIRECT INSERTION LV SINGLE-PHASE



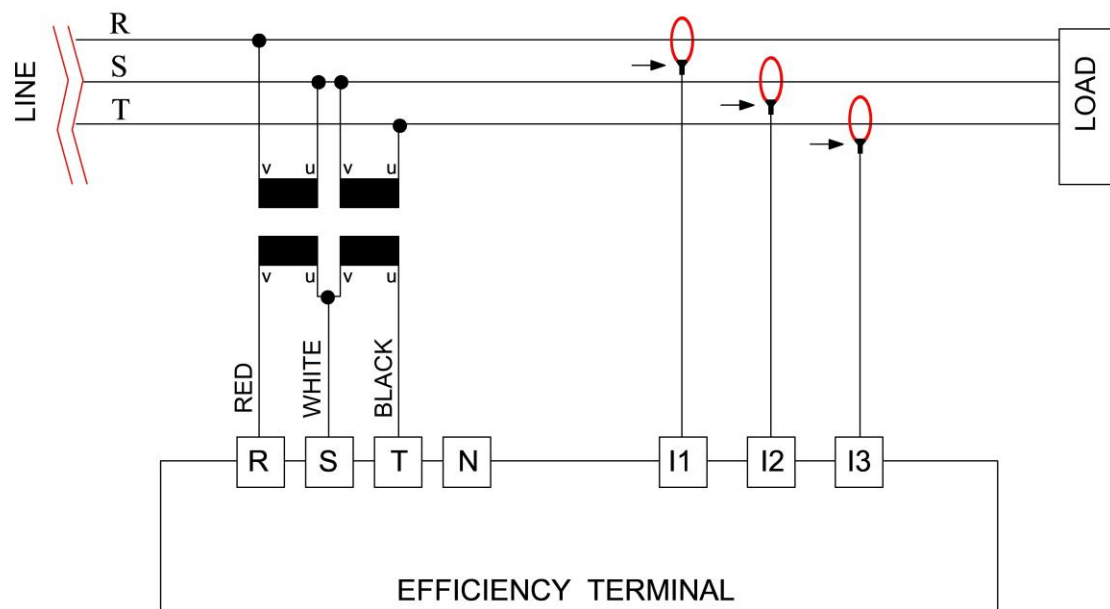
DIRECT INSERTION LV 3-PHASES

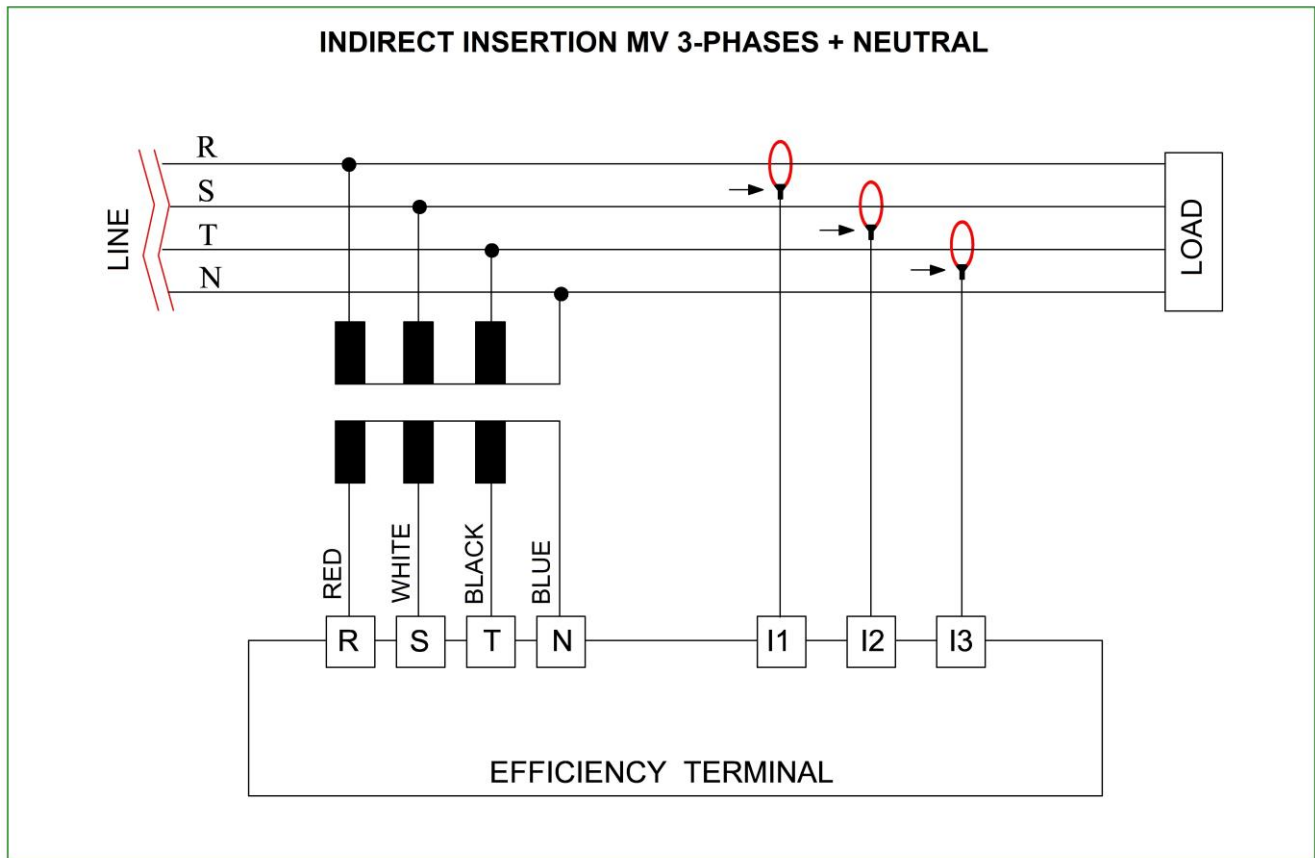


DIRECT INSERTION LV 3-PHASES + NEUTRAL



INDIRECT INSERTION MV 3-PHASES





INSTALLED OPTIONS

XM1 - It's necessary to enable this function to interface the device to Es3-Evo software. This option allows a considerable increase in the storage capacity, thus allowing the device to record all the measured values by the instrument and to extend the memory capacity of the recordable days, up to a historical archive of 250 days (Integration time of 15' for the following values: line voltage and phase voltage, three-phase line current, three-phase active power, three-phase reactive power, three-phase power factor).

XM3 – 2 digital Inputs module: It has 2 digital Inputs self powered at 12 Vdc, It allows you to acquire pulse from external meters such as: gas, water, air, etc.

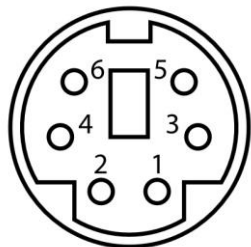
In addition, it's possible to file as a distinct procedure various acquisition channels, interrogating the stored logs by means of the specific Software.

XM6 - Module for harmonics detection. It enables the measurement and storage function for the harmonics up to the 25th.

XM14 - Power Quality. This module allows you to record the voltage gaps and peaks with a resolution of 10 ms. It's possible carry out measurements up to the 25th harmonic, both on voltage and current. It's also possible to enable a local alarm which warns when the event happens, previously set.

INSTRUCTIONS FOR CONNECTING THE INPUTS

Digital Inputs







Mini-DIN connector on the rear of the instrument. PIN description:

- 1 – Not used
- 2 – Second digital input (D3)
- 3 – First digital input (D2)
- 4 – Not used
- 5 – Not used
- 6 – Ground (common)

This instrument makes possible a measurement of 2 logical states which, in the impulsive case, can't exceed 5Hz of frequency. Externally, each digital input must be driven by a " cold contact " (passive, Not supplied) referred to " negative " clamp.

For example: If you want to connect a single-phase meter equipped by pulse output for Active-Energy measurement, it's necessary to connect it's negative output terminal to **PIN 6** on the mini-DIN and the positive output terminal (terminal of the meter) to **PIN 3** (" **First digital input** ").

Inputs for Voltage measurements

INPUT				
FUNCTION	Input R-Phase	Input S-Phase	Input T-Phase	Connection to Neutral

Inputs for Current measurements



- I1 – Connector for Rogowski probe, on the R-phase.
 - I2 – Connector for Rogowski probe, on the S-phase.
 - I3 – Connector for Rogowski probe, on the T-phase.
- (see also the paragraph: "Wiring connections and measurements ").

Each phase indication corresponding to respective Input, is written on the instrument's display, both the voltages and the currents.

Set of 3 Rogowski probes

Amperometric Rogowsky probes, coupled to Efficiency-Terminal, make possible the measurement of single and three-phase alternate currents until 2000 Ampère. Their main features consist in the possibility to be opened and the high flexibility of the “measuring ring”.

The instrument has amperometric Inputs in voltage. The following pictures show the complete system and the arrangement of these inputs, with the modality for inserting the connectors.



They are equipped by a flexible and opening sensor, with a diameter of 100 mm. The cable for output signal is shielded and is 2,5 meters long.

Very Important is installing the probe respecting the direction of the currents as indicated by the arrow on the probe, as shown in the picture below:



IMPORTANT NOTE:

Is Not recommended to extend the wiring in output over 2,5 meters: the disadvantage is in the error measure increasing, because the amplitude of the output signals is in the order of μV ($10^{-6} V$) for each Ampère and the amplifier is calibrated according to these values.

NOTE:

In function of the chosen full-scale it's necessary to configure adequately the Efficiency-Terminal. Set the primary value of the item " Current clamp range " (indication accessible by "Standard Setup" menu, see the chapter about programming by keyboard).

Low current measurement

When the values to be measured are very low than the minimum full-scale, it's possible to duplicate the sensibility of the probe thanks to flexibility of the ring. The following table shows the maximum values of the current that can be applied in the cases of two coils:

Range	Maximum current with 2 coils
125 A	~ 62



In function of the chosen typology it's necessary to configure adequately the Efficiency-Terminal. In the case of two coils, the value inserted into the instrument will be halved.

Act on the value in the " Current clamp range " menu (item accessible by " Standard Setup " menu).

NOTE: Two coils configuration must be taken with caution because it's possible the mechanical damage of the ring.

Example: If the used range is 125 A and you use 2 coils, the value to be inserted is $125/2 = 62,5$

MECHANICAL INSTALLATION AND ARRANGEMENT

We illustrate the various methods about positioning and installing the terminals on the interested measuring points. These methods are possible thanks to enclosed accessories and to mechanical feature of the instrument:



Picture 1: For voltage measurements, it's possible to insert the test leads directly into the terminals, without cutting off the connections during the installation.



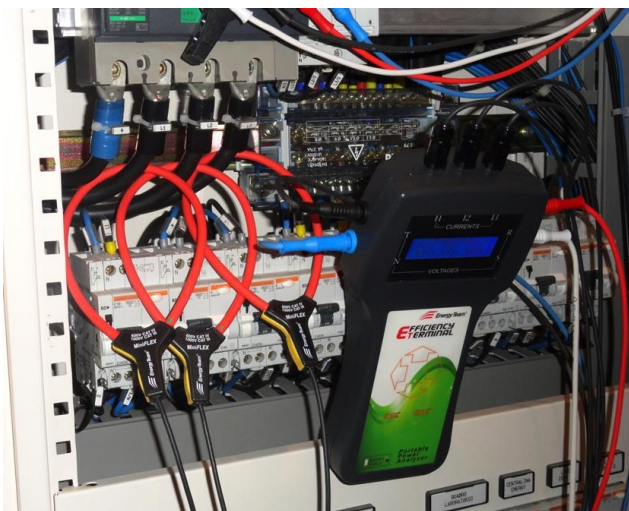
Picture 2: Arrangement of Rogowski probes, each probe around the respective phase conductor.



Picture 3: Complete arrangement for voltage and current measurements, in order to monitor also the Energy.



Picture 4: The instrument is equipped by an hanger for a comfortable positioning within the panel. In addition, it's also equipped by a magnet for an immediate fixation to the metal wall panel, with the advantage of not requiring precise positioning points.



Picture 5: The instrument is fixed within the panel, by means of the hanger.



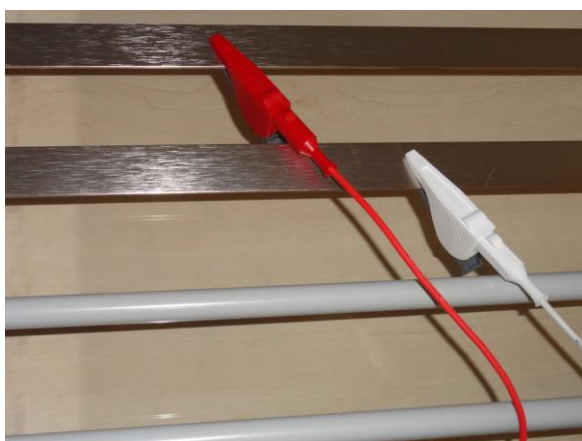
Picture 6: Detail of fastening with hanger.



Picture 7: By means of the magnet it's possible to fix the instrument to a metal wall outside the panel.



Picture 8: Another view of the instrument fixed by the magnet.



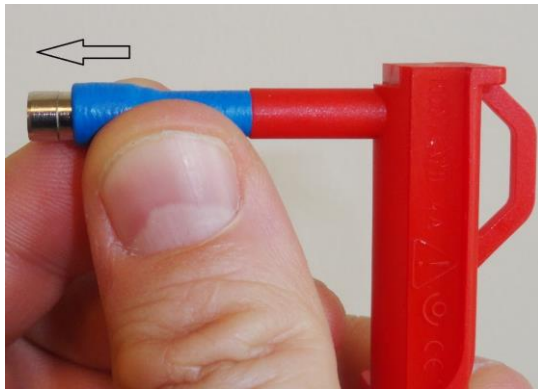
Picture 9: Crocodile clips fixed on the conductive bars during voltage measurements.

IMPORTANT NOTE:

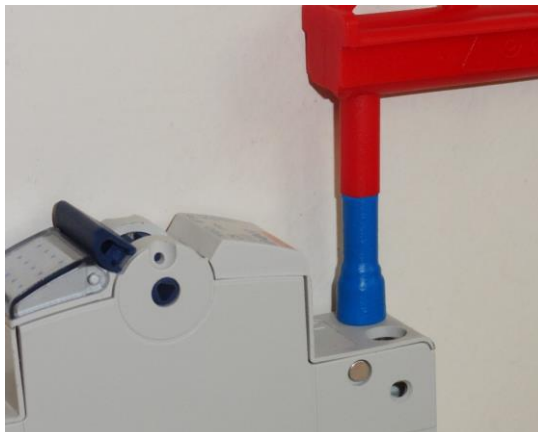
In order to verify the correctness of the measurement and the installation, see the function concerning the indication of wiring and phase rotation, pag. 28

IMPORTANT WARNING:

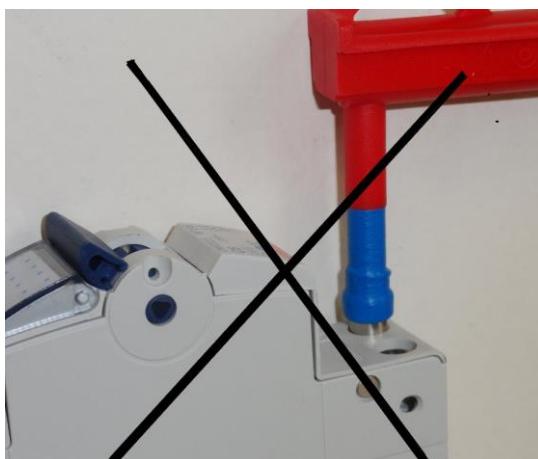
Before making the measurements, on each test lead, move the protective sheath as shown on the Picture 10 to make sure that, once it is inserted into the apposite clamp (terminal), the conductive side is entirely protected (Picture 11) and do not leave uncovered areas (Picture 12) which may give rise to dangers of exposure to voltages.



Picture 10: After a first control in the clamp, if you notice an uncovered conductive area, move the sheath as shown in this picture.

**RIGHT ARRANGEMENT**

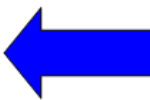
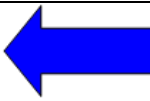








Picture 11: The conductive area is entirely in the hole.

**WRONG ARRANGEMENT**

Picture 12: The protective sheath was not extended, a conductive area is exposed.

PROGRAMMING BY KEYBOARD

In this chapter is explained the procedure for programming the Efficiency-Terminal by keyboard. Here's the **main Index of the menu:**

1.	<div>Main menu</div> <div>Standard setup</div>		Time and date setting – pages 18, 19 Current entering modality - pag. 19 TV Constant – pag. 20 Energy Price – pag. 20 Modification of PIN for SET-UP protection – pag. 21 ETPRO and ModBus Addresses – pag. 21 RS-485 speed – pag. 22
2.	<div>Main menu</div> <div>Alarm setup</div>		Function not enabled - pag. 22
3.	<div>Main menu</div> <div>Current clamp range</div>		Current range, according to Rogowski sensor used – pag. 22
4.	<div>Main menu</div> <div>Main measures</div>		Electrical measurements - pag. 22
5.	<div>Main menu</div> <div>Energies</div>		Energy meters - pag. 24
6.	<div>Main menu</div> <div>Historical charts</div>		Graphic display - pag. 25
7.	<div>Main menu</div> <div>Harmonics charts</div>		Function for displaying the graphs of the harmonics - pag. 26
8.	<div>Main menu</div> <div>Digital inputs</div>		Digital Inputs options - pag. 27
9.	<div>Main menu</div> <div>Device status</div>		Time, data, battery status and Temp. device. - pag. 27 Serial Number and Firmware - pag. 27 Options installed – pag.27 ETPRO and ModBus Addresses – pag. 28 Info about interruptions and re-start: - pag. 28 Check wiring – Pages 28, 29
10.	<div>Main menu</div> <div>Support</div>		Information about the Manufacturer - pag. 30

KEYBOARD



Meaning of the keys:

→ "RIGHT" Key

← "LEFT" Key

↑ "UP" Key

↓ "DOWN" Key

ENT: Configuration key (Enter).

ESC: To exit the configuration.

To allow the device to perform measurements, it's necessary to set the following parameters:

- DATE
- TIME
- FULL-SCALE, FOR CURRENT MEASUREMENT
- TV CONSTANT

After switching ON the device, regardless of what the display shows, it is necessary to bring the device back to the MAIN MENU by using the **LEFT** button.

Main menu

XXXXXXXXXXXX

From any point of the main menu go to the STANDARD SETUP screen by using the **UP** and **DOWN** keys.

Main menu

Standard setup

1.

From the initial screen press the **RIGHT** key to enter:

Protected page

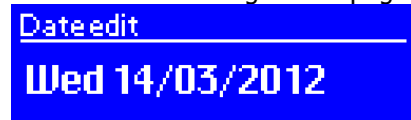
Enter PIN:0000

Press **ENT** and enter the default code **1234**, using the **UP** key.

After setting the desired numerical value, move to the second digit using the **RIGHT** button, continue until the entire code has been entered, then press **ENT**.

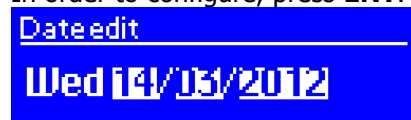
DATE SETTING (set it only on first use)

Enter the date configuration page:



Dateedit
Wed 14/03/2012

In order to configure, press **ENT**. The numbers are highlighted:



Dateedit
Wed 14/03/2012

Press **RIGHT** to go to the portion to modify, which will be the only one highlighted.

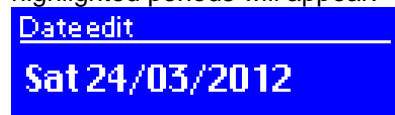
Use **ENT** to enable the possibility to modify the value within the selected period and use the **UP** and **DOWN** keys to modify the date with the correct one. When the 2 digits of the period have been modified, confirm by pressing **ENT**.

Repeat the operation until the entire date is set. After entering the final date press **RIGHT** until the following screen is displayed:



Dateedit
Wed 24/03/2012

To confirm definitively the date, press **ENT**: if the operation has been carried out correctly, the display without the highlighted periods will appear:



Dateedit
Sat 24/03/2012

TIME SETTING (set it only on first use)

IMPORTANT NOTE:

Always enter (regardless the period) only the solar time and never the day-light saving time, the device adjusts the time according to the time of the year indicated.

After setting the date, move with the **DOWN** key to the menu "Time edit". Then, as for the date, press **ENT** and the numbers are highlighted :



Timeedit
15:06:25 winter time

Then press **RIGHT** and select the time as shown below:



Timeedit
15:06:25 winter time

Press **ENT** and enter the correct time, confirming it by pressing again **ENT**; then move onto the minute digits with **RIGHT** button and repeat the operation up to the seconds.

After confirming the seconds press **RIGHT** again until the three periods are displayed as in the screen below.



Timeedit
15:06:25 winter time

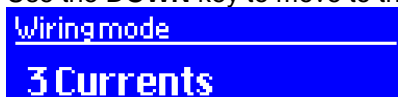
To confirm definitively the time press, **ENT**: if the operation has been carried out correctly, the display without the highlighted periods will appear:



Timeedit
15:06:29 winter time

CURRENT ENTERING MODALITY (TA)

Use the **DOWN** key to move to the next page, the following screen will appear:



Wiringmode
3 Currents

According to the type of data to enter, either 1, 2 or 3 sensors, select the modality by using **CONF** and **UP**:



Wiringmode
2 Currents

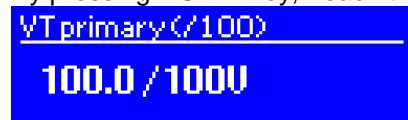
Confirm the desired modality by using **ENT**.

TV CONSTANT

NOTE:

For voltages up to 400V the configuration is already set as default. Use this section only for indirect connections (TV)

Reach the “ **Standard setup** ” menu, then press **RIGHT** key to display PIN input menu. By means of the procedure previously described, insert PIN and confirm it by pressing **ENT**, so as to get the access to configuration menu. By pressing **DOWN** key, reach this screen (only for configuring voltages over 400 V).

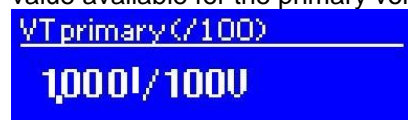


VT primary (/100)
100.0 / 100V

Then press **ENT** to configure.

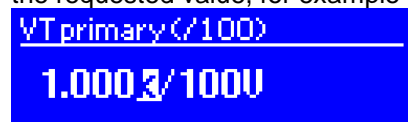
Use the **RIGHT** and **LEFT** keys to select the value to be changed, set the desired value with the **UP** and **DOWN** keys and then press **ENT** to confirm everything.

It is also possible to enter the values K (KILOVOLT), M (MEGAVOLT), G (GIGAVOLT) if the maximum numerical value available for the primary voltage is higher than 9.999 V.



VT primary (/100)
1000 / 100V

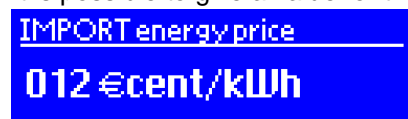
Enter **CONF** on the page and use the **RIGHT** key to move the cursor beyond the last figure, then use **UP** to select the requested value, for example K, and save with **CONF**.



VT primary (/100)
1.000 K / 100V

ENERGY PRICE

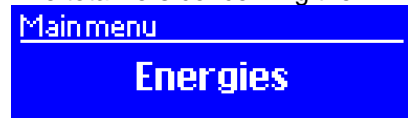
It is possible to give a value for the price of the consumed power (KWh). Move to the following screen:



IMPORT energy price
012 €cent/kWh

Through the procedure previously described, insert the new value. The same procedure is also valid in the next menu, about the “ Export energy price ”.

The totalizers concerning the IMPORT and EXPORT energy price are in the Main menu, at the section “Energies”:




Main menu
Energies

Use **RIGHT/LEFT** to move within the page, until the desired totalizer is reached:



MODIFICATION OF SET UP PROTECTION PIN

Use the **DOWN** key, the last page displayed allows you to modify the PIN to access to different SET UP.



Press **CONF** to set the new PIN, use the **RIGHT** and **LEFT** keys to move between the fields and use **UP** and **DOWN** keys to choose the new figure. Confirm by pressing **CONF**.

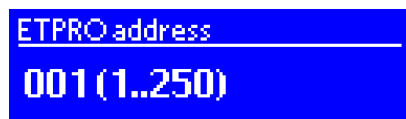
Then, by pressing the **DOWN** key, the “ Communication mode ” screen is displayed.

COMMUNICATION MODE

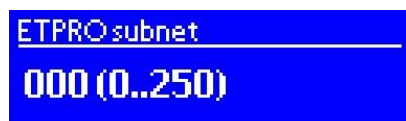
The mode can be changed by pressing **ENT**, then with **ON** you can select “Master” or another item. At the end, press again **ENT** to confirm the selected mode.

NOTE: This instrument must be left in the default configuration: “ ETPRO Slave ”.

ETPRO ADDRESS



In order to connect between them different SLAVE devices on the network, it's very important to assign to each device an address different than the others. The limit of the main network is 250 unities. Press **ENT** to enter measurement mode; then press **UP** and **DOWN** keys to insert the desired value. At the end, confirm by pressing **ENT**. If, in the main network, the number of 250 unities is exceeded, it's possible to enable other 250 addresses through the subnet, which menu is shown by pressing **DOWN**:



NOTE: In this case, leave (or set it if a wrong value was entered incorrectly) the default address “1” in the screen concerning the address, don't set anything in the screen concerning the subnet.

MODBUS ADDRESS

(not enabled in this instrument)

RS-485 Speed



RS-485 speed
9600

The available speeds are: 2400, 4800, 9600, 19200, 38400 and 57600. Considering the huge amount of data, we suggest starting from 9600.

It is necessary to have the option and the relating software Es3-Evo, which allows the use.

When finished all the operations, press **RIGHT** for returning to **Main Menu**, then **DOWN** to scroll the various menu. The next menu is the following:

2. 
Main menu
Alarm setup

Not enabled. Press again the **DOWN** key, the next menu is:

3. 
Main menu
Current clamp range

For entering this menu, press **RIGHT**. The maximum value of the set full-scale is displayed. It depends by the Rogowski sensor used. If you want to set a new value, press **ENT**. It lights:



Current clamp range
2000 Hmp F.S.

By using **DOWN**, select one of the following values: 62,5 – 125 – 250 – 500 – 1000 – 2000, then confirm by pressing **ENT**.

Press different times the **LEFT** key until to return to **Main Menu**, then press **DOWN** or **UP** to display:

4. 
Main menu
Main measures

By pressing the **RIGHT** key and then **DOWN** or **UP** it's possible to scroll the screens displaying in real time the state of the measures, as shown in the next page:

LINE VOLTAGE	Threephase system - page 1 U Δ 0.000 I λ 0.000 P Σ 0.000 PF 1.000	LINE CURRENT
THREE-PHASE ACTIVE POWER		POWER FACTOR
THREE-PHASE ACTIVE POWER	Threephase system - page 2 P Σ 0.000 Q Σ 0.000 S Σ 0.000 D Σ 0.000	THREE-PHASE REACTIVE POWER
THREE-PHASE APPARENT POWER		THREE-PHASE DISTORTION POWER
STAR POINT VOLTAGE	Threephase system - page 3 U o 0.000 I o 0.000 F 50.00	NEUTRAL CURRENT
FREQUENCY		
LINE VOLTAGE	Threephase system - page 4 U Δ 0.000 I λ 0.000 P Σ 0.000 F 50.00	LINE CURRENT
THREE-PHASE ACTIVE POWER		FREQUENCY

“Page 4” indicates the values requested by the RINA standards (Italian Ship Register) in force in the shipbuilding sector. To save data more than 3 days it is necessary to have the option and the relating software Es3-Evo.

From pages 1 and 2 of this menu it's possible, through the **RIGHT** key, to get the access to another list of measures, selectable by **UP** and **DOWN** keys.

Phase to neutral voltage L1N V L2N V L3N V 0.000 0.000 0.000	Phase to phase voltage L12 V L23 V L31 V 0.000 0.000 0.000	Line current I1 A I2 A I3 A 0.000 0.000 0.000
Power factor PF1 PF2 PF3 1.000 1.000 1.000	Active Power P1 W P2 W P3 W 0.000 0.000 0.000	Reactive power Q1 VAr Q2 VAr Q3 VAr 0.000 0.000 0.000
Harmonic power D1 VA D2 VA D3 VA 0.000 0.000 0.000	Apparent power S1 VA S2 VA S3 VA 0.000 0.000 0.000	Voltage THD L1 % L2 % L3 % 0.000 0.000 0.000
Current THD L1 % L2 % L3 % 0.000 0.000 0.000		

FULL SCREEN DISPLAY

From each of these screens you can display, on a full screen, by pressing the **RIGHT** key, the values of the three measures summarized in the above screens. Use **UP** and **DOWN** to get the access directly to individual displayable measures.

Three phase wye voltage L123 0.000
--

When finished, press different times the **LEFT** key until to **Main menu**, then press **DOWN** to reach the menu **Energies**:

Main menu Energies

3.

Press **RIGHT** to enter ENERGY METERS submenu.

ENERGY METERS

By means of this function it's possible having **two** meters, which can be set to zero: **B1** and **B2**. In each meter it's possible to display a detail of other sub-meters:

1. Imported active energy
2. Exported active energy
3. Imported inductive energy
4. Exported inductive energy
5. Imported capacitive energy
6. Exported capacitive energy



In each group, the six sub-meters can be scrolled by using the **UP** and **DOWN** keys and, from the meter display, press **RIGHT** to get an access to zero setting function, which deletes all the values of the six meters in the selected group B1 or B2.

Use **ENT** and then **UP** or **DOWN** to set the desired answer (YES or NO). If you have selected YES, press **ENT** to set to zero.



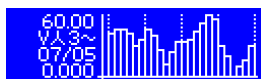
When finished, press different times the **LEFT** key for returning to **Main menu**, then **DOWN** until to menu **Historical charts**. (The same procedure is also valid for the other screens of the Main menu, getting the access to respective submenu through the **RIGHT** key).



GRAPHS DISPLAYING

It's possible saving, as a graph, maximum 3 days of the following selectable values:

1. Phase-neutral voltage



2. Phase-phase voltage



3. Line current



4. Active power



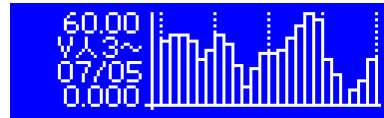
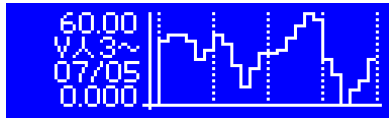
5. Reactive power



6. Power factor



Use the **RIGHT** key to select one of the six above values, and use **DOWN** to select the type of graph (with segments or histograms). The graph is daily for the 24 hours, where each segment represents an hour and the value displayed is the average hourly value of the electric measure set.

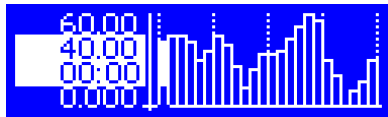


Use the **UP** key to scroll backwards and display the previous days.
The following values are indicated in the graph:

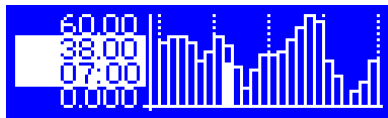
- 60.00 Indicates the maximum value of the graph.
- V^3~ Indicates the electric value.
- 07/05 Indicates the date.
- 0.000 Indicates the minimum value of the graph.

Press **ENT** to display the real values of each hour, and then move using the **RIGHT** and **LEFT** keys to change the hour interval (Important: the hour displayed refers to the beginning of the selected interval).

Here's two examples:



This screen displays the value of the energy measure selected, equal to 40.00, in the time span from midnight to 01:00 am



This screen displays the value of the energy measure selected, equal to 38.00, within the time interval from 07:00 to 08:00



HARMONICS GRAPHS DISPLAYING

Following the same methodology used in the preview section, it's possible to display in graphical form:

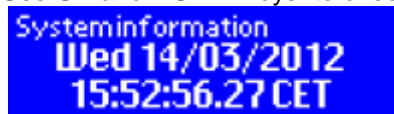
- Distorting V3
- Distorting VL1
- Distorting VL2
- Distorting VL3
- Distorting I3
- Distorting IL1
- Distorting IL2
- Distorting IL3



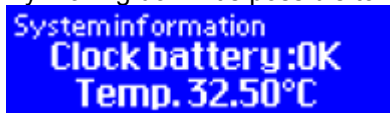
For the configuration it's necessary to have the option and the relating software Es3-Evo.



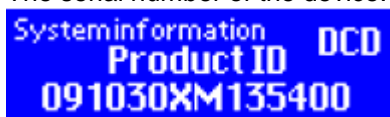
Use **UP** and **DOWN** keys to check the date and time of the instrument:



By moving down it's possible to verify the state of the battery and the internal temperature of the device:



The serial number of the device:



The installed Firmware version:



The alarm status:



The information about the options installed:



The information about the last re-start, the last switch-off and the cause of the re-start:

System information
Last restart
14/03/2012 14:42:01

System information
Last shutdown
08/03/2012 15:21:24

System information
Restart cause
Power outage

The default ETPRO address:

System information
ETPRO address
000:001

The default MODBUS address:

System information
MODBUS address
001

The indication of correct wiring:

System information
Check Wiring
LOW LOW LOW
LOW LOW LOW

FUNCTION FOR CHECKING THE CORRECT INSTRUMENT INSERTION

The instrument is equipped by a function for checking the correct insertion on the plant by estimating the position of the Voltage and Current vectors in the tern under test; according to position of these vectors, the instrument seeks to attribute a phase and a polarity to signals connected.

The determination takes place by considering, as a reference, the Voltage channel L1 and determining the relative phase shifts of all others.

In order to get coherent results, the power factor of the plant must be between 0,78 inductive and 0,92 capacitive, outside this range the vectors are no longer attributable with certainty. The insertion is considered right if the phasors are in the range of the following values in degrees:

	Voltage			Current		
	L1	L2	L3	L1	L2	L3
From:	357	115	233	346	93	210
To:	9	127	244	42	160	284

Harmonics of high intensity or impulse noise can adversely affect the calculation.

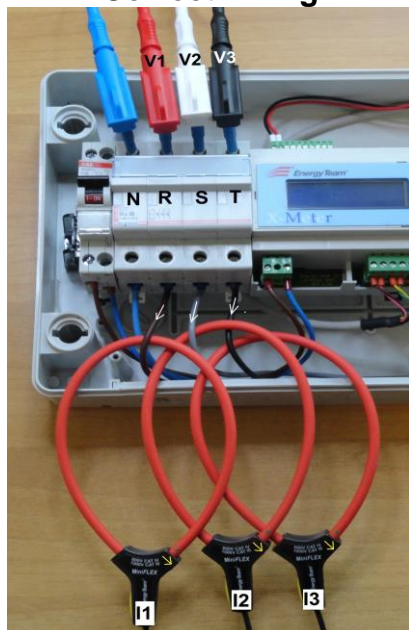
Here's the screen corresponding to the function:

Informazioni di sistema
Verifica Cablaggio
LOW LOW LOW
LOW LOW LOW

It can be reached through the steps above described. The voltage sensors must be installed respecting the cyclic sense of the phases R-S-T, the Current Rogowski sensors must be installed also respecting the polarity: when the current flows from line to load, direction must comply with the arrow printed on the probe.

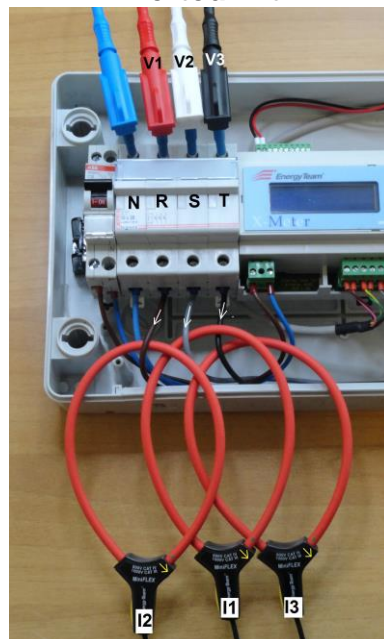
Let's describe below some examples of correct and incorrect wiring, with the respective information on the display.

Correct wiring



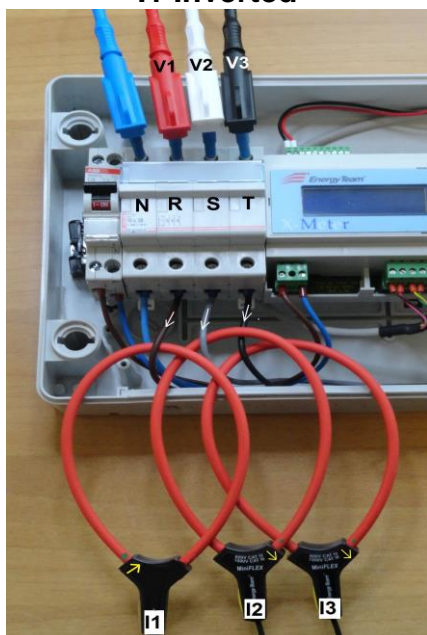
```
System information
Check Wiring
+V1 +V2 +V3
+I1 +I2 +I3
```

I2 Inverted with I1



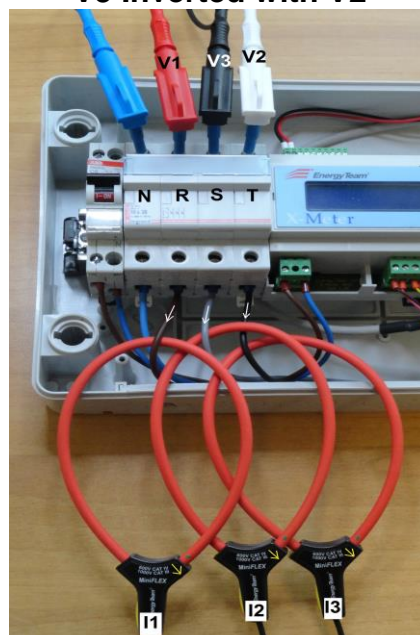
```
System information
Check Wiring
+V1 +V2 +V3
+I2 +I1 +I3
```

I1 Inverted



```
System information
Check Wiring
+V1 +V2 +V3
-I1 +I2 +I3
```

V3 Inverted with V2



```
System information
Check Wiring
+V1 +V3 +V2
+I1 +I2 +I3
```


Returning to Main menu, this is the last screen, about the support and information:



Press **RIGHT** to display the information relating our web site, at the web site @ to contact us, our telephone number for assistance, with an additional space where it's possible to set the name of the power distributor used.

CONFIGURATION OF SERIAL PORT FOR DATA DOWNLOADING

Here we describe the procedure to set and configure the system described above, through the menu in the Es3-Evo software, including the serial port for data downloading. First, we describe the steps to configure the drivers. Follow the steps described.

DRIVER INSTALLATION AND CHECKING PORT

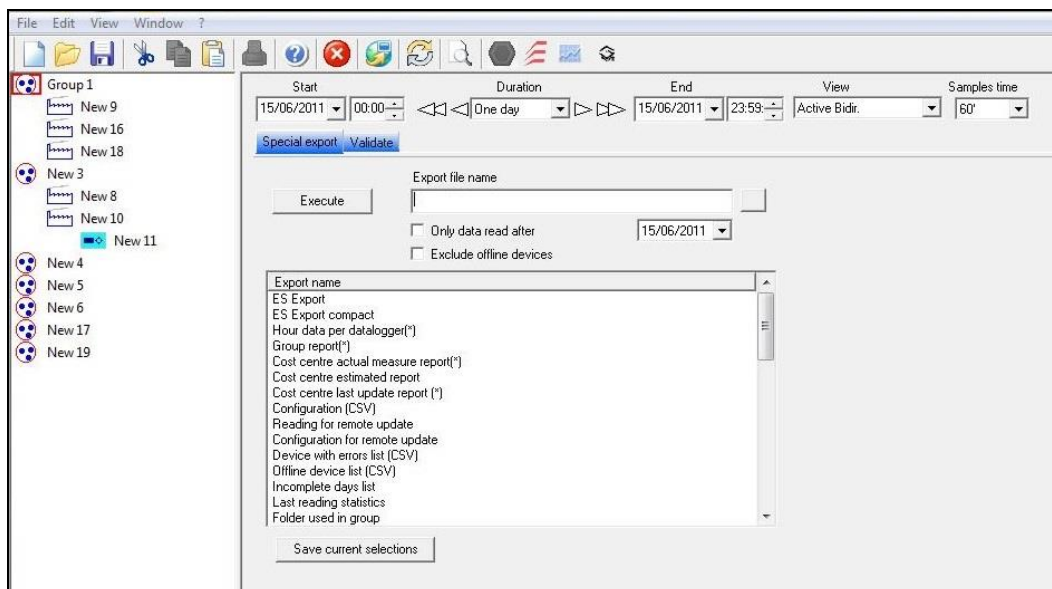
- Connect Efficiency Terminal to PC through the USB cable supplied.
- Wait until the automatic search of the “ New driver ” in Windows is completed.
- The drivers are on the CD supplied. In this CD, in the directory XM2 (you can get the access also through a manual procedure) activate the application “**CDM 2.04.06**” (.exe) by clicking on the corresponding icon. The drivers are installed.
- From this route: START/Control Panel/System/Device Manager/ Controller USB (Universal Serial Bus), select the last device on the list (USB Serial Converter), then click with the right mouse button and select “Properties”. From the menu displayed, select the form called “Advanced” and check the box “VCP Loading”.
- Extract the USB connector and reinsert it, in order to check the route of COM port: START/Settings/Control Panel/System/Hardware/Device Manager/Ports (COM and LPT).
- The name of the port shown must be entered into the field “Channel” in the menu “Site configuration data”, referred to software Es3-Evo, that we now see in more detail.

NOTE:

The name of the directories could change, even if not by much. It depends by the operative system used and by its versions.

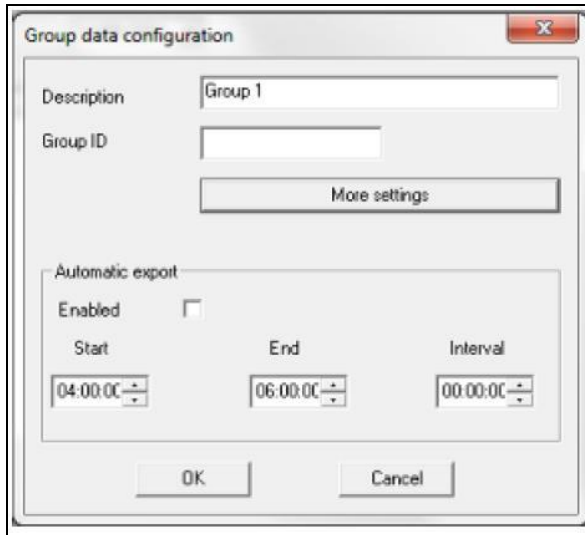
SOFTWARE CONFIGURATIONS

This is the first menu displayed when Es3-Evo software has been started:



GROUP AND SITE CONFIGURATION

On the first vertical column, the icon called “Group” represents the place where the plant is located. In order to create a new group, click on this icon with the mouse right button. From the drop-down menu select the item “ **Add group** ”, this mask is shown:



The dialog box titled "Group data configuration" contains the following fields and controls:

- Description:** A text input field containing "Group 1".
- Group ID:** An empty text input field.
- More settings:** A button located below the Group ID field.
- Automatic export:** A section containing:
 - Enabled:** A checkbox that is currently unchecked.
 - Start:** A time selection field showing "04:00:00".
 - End:** A time selection field showing "06:00:00".
 - Interval:** A time selection field showing "00:00:00".
- OK** and **Cancel** buttons at the bottom.

Let's explain the fields:

Description: Enter the name of the group.

Group ID: You can enter a word for an eventual search.

Automatic export:

Enabled: If you want an automatic data export within a certain time interval, check the box.

Start; End: Set respectively the Start and End hours of the time interval in which data export occurs.

Interval: Enter the “cadency” of data export into the time interval set.

Example: by entering 00:20:00, the measured and stored values are exported every 20 minutes.

Press **OK** to save the set parameters (and the group), or **Cancel** to exit without saving them.

If you want to modify some parameters to newly created group, display again the mask by clicking with the mouse right button on the Group icon and select **Modify**.

If you want to subdivide the group into different subgroups (for example: a building with different sections where, each of them, include a plant and some instruments):

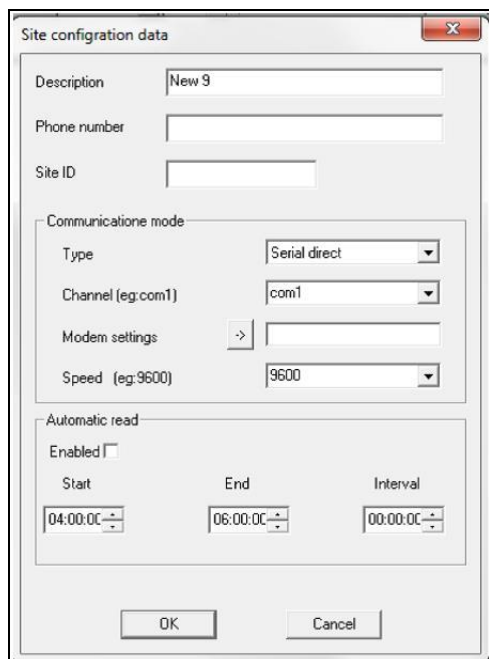
Click with mouse right button on the Group icon → Select **Add subgroup** → Repeat the described procedure.

In case of automatic export, to change times momentarily:

Click with mouse right button on the Group or Subgroup icon → Select **Change times read** → Check the box **Skip current time** → as already explained, insert the new time interval into section **New time**.

If you want to create a new site (corresponding to considered electrical plant):

Click with mouse right button on the icon corresponding the Group or Subgroup → from the drop-down menu, select the item **Add site** → Fill in the fields of the mask displayed, as shown in the next page:



The dialog box is titled "Site configuration data". It contains the following fields and controls:

- Description:** A text box containing "New 9".
- Phone number:** An empty text box.
- Site ID:** An empty text box.
- Communications mode:** A group box containing:
 - Type:** A dropdown menu with "Serial direct" selected.
 - Channel (eg:com1):** A dropdown menu with "com1" selected.
 - Modem settings:** A button labeled "->" next to an empty text box.
 - Speed (eg:9600):** A dropdown menu with "9600" selected.
- Automatic read:** A group box containing:
 - Enabled:** An unchecked checkbox.
 - Start:** A time picker showing "04:00:00".
 - End:** A time picker showing "06:00:00".
 - Interval:** A time picker showing "00:00:00".
- Buttons:** "OK" and "Cancel" buttons at the bottom.

Description: Enter the name of the site.

Site ID: It identifies the equipment which sends the pulses.

Type: Select "Serial direct".

Channel: As explained on the paragraph about the driver installation, insert the port identified, to which the instrument is connected.

Speed: Enter the same value set on the instrument. Default is 9600. .

AUTOMATIC READ

Enabled: If you want an automatic data reading within a time interval, check the box.

Start; End: Set respectively the Start and End hours of the time interval in which data reading occurs.

Interval: Enter the "cadency" of time interval in which the automatic data reading of information occurs.

Example: By inserting 00:15:00, automatic data reading occurs every 15 minutes.

Press **OK** to save the set parameters, or **Cancel** to exit without saving them.

NOTE:

We have described the most important part of the software about configuring the serial port for data downloading. The other parts as: creation of a peripheral device, digital inputs configuring, pulse setting, are the same as described on the manual Es3-Evo, from page 7 (Creation and configuration of peripheral devices). We refer to these paragraphs.

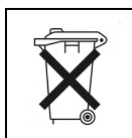
GENERAL SAFETY RULES

- Efficiency-Terminal equipment must be used only by a staff skilled and qualified.
- Before opening the case, remove any type of power and connection to terminals of the device, **WARNING: the equipment is connected to voltages of 230 Vac and 400 Vac.**
- Don't use it in presence of water.
- Regarding the connections of the equipment, respect strictly the indications and the screens reported in this manual.

WARRANTY

Energy Team guarantees that the supplied products are free from defects and suitable for use. If any malfunction occurs and these are due to manufacturing defects, E.T. will respond within the terms and modalities foreseen by General Conditions of Supply, with particular reference to articles **5B** (terms and duration), **1C** (limits), **5D** (other warranties). Whatever operation or manumission made by third parties not expressly authorized determines in each case the immediate termination of the warranty.

DISPOSAL



WASTE OF ELECTRICAL AND ELECTRONIC EQUIPMENT (WEEE)

Don't dispose among generic waste but collect separately for recycling and disposal operations according by law.

EFFICIENCY-TERMINAL CALIBRATION CERTIFICATE

We certify that this device was calibrated by means of:

- Calibrator CALMET C300 S.N. 19091
- Nr.3 Rogowski amperometric probes, S.N. 120615; 120602; 120626
- Coil CALMET ZW100/10A S.N. 19095

References: 6 Atrms , 50 Hz (600 A at secondary)
1 Atrms 50 Hz (100 A at secondary)
100 Vtrms , 50 Hz

Accuracy verified: $\pm 0,1\%$ of the range
 $\pm 0,25\%$ in the reading (Efficiency-Terminal equipment and Miniflex Rogowski)

Values measured after calibration equipment				
Nominal values in Input	Values			
	Range	Max	Min	Verified
600 Atrms	1000A	602,5	597,5	
100 Atrms	1000A	101,25	98,75	
100 Vtrms	300V	100,55	99,45	

Offset Calibration: ☐ OK

Date: _____

Technician: _____

S.N. _____

Note : To ensure and maintain a specified accuracy we recommend to check the instrument every 24 months.

Installed Options:

<u>XM3</u>	<u>XM6</u>	<u>XM14</u>										
------------	------------	-------------	--	--	--	--	--	--	--	--	--	--